CLAIMS

The invention claimed is:

1. A method of forming an opening through a masking layer, comprising utilization of at least two sequential photomasking steps which in combination form the opening through the masking layer but which are not sufficient alone to form the opening through the masking layer; the photomasking steps each comprising utilization of an etch to pattern the masking layer while a patterned photoresist mask is over the masking layer and each utilizing a separate photoresist mask from one another.

2. The method of claim 1 wherein the masking layer comprises silicon and nitrogen.

3. The method of claim 1 wherein the masking layer consists essentially of silicon, oxygen and nitrogen.

4. The method of claim 1 wherein the opening has a substantially polygonal shape.

5. The method of claim 1 wherein the opening has a substantially diamond shape.

6. The method of claim 1 wherein the opening has a substantially rectangular shape.

7. The method of claim 1 wherein the opening has a substantially square shape.

8. The method of claim 1 wherein the masking layer is over an electrically insulative material, and wherein the opening is utilized to form a capacitor container within the electrically insulative material.

9. The method of claim 1 wherein:

the masking layer consists essentially of silicon, oxygen and nitrogen;

the masking layer is over a layer consisting essentially of amorphous carbon;

the layer consisting essentially of amorphous carbon is over an electrically insulative material; and

the opening in the masking layer is utilized to form a capacitor container within the electrically insulative material.

10. A method of forming an opening, comprising the following steps in the following order:

providing a substrate having a masking layer, the masking layer having an initial thickness;

forming a first patterned photoresist over the masking layer;

using the first patterned photoresist during a first etch into the masking layer, the first etch extending to a depth in the masking layer that is less than the initial thickness of the masking layer;

forming a second patterned photoresist over the masking layer;

using the second patterned photoresist during a second etch into the masking layer, the second etch extending to a depth in the masking layer that is less than the initial thickness of the masking layer; the combined depths to which the first and second etches extend into the masking layer being greater than the initial thickness of masking layer; the first and second etches forming the masking layer into a patterned mask having a third pattern different from the patterns of the first and second patterned photoresists; and

using the patterned mask to pattern a region of the substrate beneath the patterned mask.

11. The method of claim 10 wherein the masking layer comprises silicon and nitrogen.

12. The method of claim 10 wherein the masking layer comprises silicon, oxygen and nitrogen.

13. The method of claim 10 wherein the masking layer consists essentially of silicon, oxygen and nitrogen.

14. The method of claim 10 wherein the substrate comprises at least two materials, a second material of the at least two materials being between a first material of the at least two materials and the masking layer; wherein the second material is patterned with a third etch while using the patterned mask formed from the masking layer; and wherein the first material is patterned while using the patterned second material as a mask and with a fourth etch different from the third etch.

15. The method of claim 14 wherein the substrate comprises a semiconductor base; and wherein the at least two materials are over the semiconductor base.

16. The method of claim 14 wherein the masking layer comprises silicon and nitrogen, and wherein the second material consists essentially of amorphous carbon.

17. The method of claim 14 wherein the masking layer comprises silicon and nitrogen, wherein the second material consists essentially of amorphous carbon, and wherein the first material consists essentially of doped silicon oxide.

18. The method of claim 14 wherein the first material comprises a doped silicon oxide and the second material comprises amorphous carbon.

19. The method of claim 14 wherein the first material comprises a doped silicon oxide, the second material comprises amorphous carbon and the masking layer comprises silicon oxynitride.

20. The method of claim 14 wherein the first material consists essentially of a doped silicon oxide, the second material consists essentially of amorphous carbon and the masking layer consists essentially of silicon oxynitride.

21. The method of claim 10 wherein the first pattern comprises substantially linear downwardly-projecting first features, wherein the second pattern comprises substantially linear downwardly-projecting second features, and wherein locations of the downwardly-projecting second features are at approximately right angles to locations of the downwardly-projecting first features.

22. A method of forming an opening, comprising:

providing a substrate having a layer, the layer having a thickness;

photolithographically forming a first pattern over the layer, the first pattern comprising a first series of downwardly-projecting features;

transferring a substantial reproduction of the first pattern into the layer to a depth which extends less than entirely through the thickness of the layer;

after transferring the substantial reproduction of the first pattern into the layer, photolithographically forming at least one subsequent pattern over the layer, the at least one subsequent pattern comprising a second series of downwardly-projecting features, at least some of the downwardly-projecting features of the second series crossing locations of at least some of the downwardly-projecting features of the first series; and

transferring a substantial reproduction of the at least one subsequent pattern into the layer to a depth which extends less than entirely through the thickness of the layer, the combined depths to which the substantial reproductions of the first pattern and the at least one subsequent pattern are transferred into the layer being entirely through the thickness of the layer.

23. The method of claim 22 wherein the layer is over a stack of materials, wherein the combined substantial reproductions of the first pattern and at least one subsequent pattern form the layer into a patterned mask having a designated pattern, and further comprising extending a substantial facsimile of the designated pattern into at least one of the materials underlying the patterned mask.

24. The method of claim 23 wherein the stack comprises a semiconductor substrate and at least two of the materials over the substrate; the two materials being a first material and a second material; the second material being over the first material; wherein a first substantial facsimile of the designated pattern is transferred through the second material with first etching conditions; and wherein a second substantial facsimile of the designated pattern is subsequently transferred to the first material with second etching conditions which are different from the first etching conditions.

25. The method of claim 24 wherein the first material comprises silicon and oxygen, the second material comprises a spin-on material and the layer comprises silicon and nitrogen.

26. The method of claim 24 wherein the first material comprises a doped silicon oxide, the second material comprises amorphous carbon and the layer comprises silicon oxynitride.

27. The method of claim 22 wherein the downwardly-projecting features of the second series cross the downwardly-projecting features of the first series at approximately right angles.

28. The method of claim 22 wherein the at least one subsequent pattern is only one subsequent pattern.

29. A method of forming container capacitors, comprising:

providing a semiconductor substrate;

forming a container-scaffold-material over the semiconductor substrate;

forming a masking layer over the container-scaffold-material;

photolithographically forming a first pattern over the first masking layer, the first pattern comprising a first series of trenches;

after forming the first pattern, photolithographically forming a second pattern over the first masking layer, the second pattern comprising a second series of trenches; at least some trenches of the second series crossing locations of at least some of the trenches of the first series, regions where trenches of the second series overlap locations of trenches of the first series being defined as overlap regions and regions where trenches of the second series do not overlap locations of trenches of the first series being defined as non-overlap regions;

forming the masking layer into a patterned mask by extending the overlap regions entirely through the masking layer while not extending the non-overlap regions entirely through the masking layer;

using the patterned mask to form capacitor containers within the container-scaffold-material; and

forming a first capacitor electrode, dielectric material and second capacitor electrode extending within the capacitor containers to form capacitor structures within the capacitor containers.

30. The method of claim 29 wherein the masking layer comprises silicon and nitrogen.

31. The method of claim 29 wherein the masking layer consists essentially of silicon, nitrogen and oxygen.

32. The method of claim 29 wherein the container-scaffold material comprises silicon and oxygen.

33. The method of claim 29 wherein the container-scaffold material consists essentially of a doped silicon oxide.

34. The method of claim 33 wherein the container-scaffold material consists essentially of borophosphosilicate glass.

35. The method of claim 29 further comprising an intervening material between the container-scaffold-material and the masking layer, and wherein the using the masking layer to form capacitor structures within the container-scaffold-material comprises:

using the patterned mask during an etch through the intervening material which patterns the intervening material; and

using the patterned intervening material during an etch of the container-scaffold-material.

36. The method of claim 35 wherein the intervening material is substantially selectively etchable to both the masking layer and the container-scaffold-material.

37. The method of claim 35 wherein the container-scaffold-material comprises a doped silicon oxide, wherein the intervening material comprises amorphous carbon, and wherein the masking layer comprises silicon oxynitride.

38. The method of claim 29 wherein the second series of trenches are substantially orthogonal to locations of the first series of trenches.

39. The method of claim 29 wherein the overlap regions are substantially diamond in shape.

40. The method of claim 29 wherein the overlap regions are substantially rectangular in shape.

41. The method of claim 29 wherein the first series of trenches are wavy lines.

42. The method of claim 29 wherein the first series of trenches are wavy lines, and wherein the second series of trenches are substantially straight lines that are substantially orthogonal to locations of the first series of trenches.

43. A method of forming container capacitors, comprising:

providing a semiconductor substrate;

forming an electrically insulative material over the substrate;

forming a pair of masking layers over the electrically insulative material; the pair of masking layers being a first masking layer and a second masking layer, the first masking layer being between the second masking layer and the electrically insulative material; the second masking layer having a thickness;

photolithographically forming a first pattern over the second masking layer, the first pattern comprising a first series of trenches;

transferring a substantial reproduction of the first pattern into the second masking layer to a depth which extends less than entirely through the thickness of the second masking layer;

after transferring the substantial reproduction of the first pattern into the second masking layer, photolithographically forming a second pattern over the second masking layer, the second pattern comprising a second series of trenches; at least some of the trenches of the second series crossing locations of at least some of the trenches of the first series;

transferring a substantial reproduction of the second pattern into the second masking layer to a depth which extends less than entirely through the thickness of the second masking layer, the combined depths to which the substantial reproductions of the first and second patterns are transferred into the second masking layer being entirely through the thickness of the second masking layer; the combined transferring of the substantial reproductions of the first and

second patterns into the second masking layer forming the second masking layer into a patterned mask over the first masking layer; the patterned mask having a capacitor container pattern which defines capacitor container locations as regions where overlap occurs between trenches of the second series and trenches of the first series;

transferring a substantial reproduction of the capacitor container pattern from the patterned mask into the first masking layer;

transferring a substantial reproduction of the capacitor container pattern from the first masking layer into the electrically insulative material to form capacitor containers within the electrically insulative material; and

forming a first capacitor electrode, dielectric material and second capacitor electrode extending within the capacitor containers to form capacitor structures within the capacitor containers.

44. The method of claim 43 wherein the second series of trenches are substantially orthogonal to the first series of trenches.

45. The method of claim 43 wherein the capacitor container locations are substantially diamond in shape.

46. The method of claim 43 wherein the capacitor container locations are substantially rectangular in shape.

47. The method of claim 43 wherein either the first series of trenches or the second series of trenches are wavy lines.

48. The method of claim 43 wherein the first series of trenches are wavy lines.

49. The method of claim 43 wherein the first series of trenches are wavy lines, and wherein the second series of trenches are substantially straight lines that are substantially orthogonal to the first series of trenches.

50. The method of claim 43 wherein the electrically insulative material comprises a doped silicon oxide.

51. The method of claim 50 wherein the electrically insulative material comprises a thickness of from about 5,000Å to about 30,000Å.

52. The method of claim 50 wherein the first masking layer comprises amorphous carbon.

53. The method of claim 52 wherein the first masking layer comprises a thickness of from about 1,000Å to about 10,000Å.

54. The method of claim 52 wherein the second masking layer comprises silicon oxynitride or silicon nitride.

55. The method of claim 52 wherein the second masking layer comprises a thickness of from about 300Å to about 5,000Å.

56. The method of claim 43 wherein the first pattern is transferred about halfway through the thickness of the second masking layer.

57. The method of claim 43 further comprising incorporating the container capacitors into a DRAM array.

58. A container capacitor structure, comprising:

a container-shaped first capacitor electrode, the container-shape having an open end and a periphery around the open end, the periphery comprising a substantially pentagonal shape;

a dielectric material extending into the container shape of the container-shaped first electrode; and

a second capacitor electrode capacitively separated from the first capacitor electrode by at least the dielectric material.

59. The container capacitor structure of claim 58 wherein the second capacitor electrode extends into the container shape of the container-shaped first capacitor electrode.

60. A computer memory device comprising one or more of the container capacitor structures of claim 58.

61. A DRAM array comprising a plurality of the container capacitor structures of claim 58.

62. An electronic system comprising the DRAM array of claim 61.

63. A capacitor structure, comprising:

a semiconductor substrate;

an insulative material over the semiconductor substrate;

a container opening extending into the insulative material, the container opening having a vertical dimension corresponding to a depth of the opening and a horizontal dimension orthogonal to the vertical dimension, and comprising a substantially five-sided cross-section along the horizontal dimension; and

a first capacitor electrode, a dielectric material and a second capacitor electrode extending within the container opening.

64. A computer memory device comprising one or more of the capacitor structures of claim 63.

65. A DRAM array comprising a plurality of the capacitor structures of claim 63.

66. An electronic system comprising the DRAM array of claim 65.

67. A DRAM array, comprising:

a semiconductor substrate supporting a plurality of transistor devices;

an insulative material over the semiconductor substrate, the insulative material comprising a doped silicon oxide and having a thickness of from about 5,000Å to about 30,000Å;

a plurality of container openings extending into the insulative material, the container openings each having a vertical dimension corresponding to a depth of the opening and a horizontal dimension orthogonal to the vertical dimension, and the container openings each comprising a substantially pentagonal cross-section along the horizontal dimension;

a first capacitor electrode, a dielectric material and a second capacitor electrode extending within the container openings to form a plurality of container capacitors; and

electrical connections between the first capacitor electrodes and the transistor devices.

68. The DRAM array of claim 67 wherein the insulative material comprises BPSG.

69. An electronic system comprising the DRAM array of claim 67.